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International Symposium
on
INHALATION TOXICOLOGY

„The Design and Interpretation
of Inhalation Studies and their Use in
Risk Assessment"

March 23 – 27, 1987
Hannover Medical School
Hannover, Federal Republic of Germany

Sponsored by

The International Life Sciences Institute
Hannover Medical School
and
The Fraunhofer Institute of Toxicology
and Aerosol Research

In co-operation with
American Association for Aerosol Research
Association of German Engineers
Gesellschaft für Aerosolforschung
(Society for Aerosol Research)
Japanese Society of Toxicologic Pathologie

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Program Outline

Sunday, March 22

17.00 – **Registration**
19.00

Monday, March 23

08.00 **Registration**

09.15 **Welcoming Speeches**
Prof. Dr. med. K. Alexander,
Rector Hannover Medical School

Introduction and Announcements
Werner Stöber, Dr. rer. nat.

Plenary Session A (Lecture Hall F)

Approaches to Assessing the Toxicity of Airborne Toxicants
Roger O. McClellan, D.V.M., Session Chairman

09.30 **Standard-setting as an Integrative Exercise: Alchemy, Juggling or Science?**
David V. Bates, M.D.
University of British Columbia

10.10 **Species Differences in Inhalation Toxicology: Variations in Exposure–Dose Relationships and Macrophage Function**
Joseph D. Brain, S.D. in Hygiene
Harvard School of Public Health

10.50 ●●● Break ●●●

11.20 **Cell Populations of the Respiratory System: Interspecies Diversity in Composition, Distribution and Morphology**
Charles G. Plopper, Ph.D.
University of California, Davis

12.00 **Comparative Metabolic Basis for the Disposition and Toxic Effects of Inhaled Materials**
Alan R. Dahl, Ph.D.
Lovelace Inhalation Toxicology Research Institute

12.40 ●●● Lunch ●●●

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Monday Afternoon Paper Sessions A and C Will Be Presented Concurrently.

Paper Session A (Lecture Hall F)
Session Chairman: Joseph D. Brain, S.D. in Hygiene
Co-chairman: Hartwig Muhle, Dr. rer. nat.

14.00 **An Integrated Screening Method for Evaluating the Toxicity of Inhaled Particulates: Validation of the Method**
D.B. Warheit, Du Pont-Haskell Lab, Newark, DE, USA

14.15 **A Multidimensional Approach to the Characterization of Acid Aerosols for Health Effects**
C.A. Franklin and B. Stern, Environmental Health Directorate, Department of National Health and Welfare, Ottawa, Canada

14.30 **Cellular Approaches to Assess the Toxicity of Airborne Toxicants on Airway Epithelial Pathophysiology**
G. Leikauf, University of Cincinnati, Cincinnati, OH, USA

14.45 **In Vitro/Ex Vivo Investigations on the Effects of Carcinogens and Potential Lung Irritants to Lung and Liver Cells**
B.L. Pool, P. Aulenbacher*, R.G. Klein, P. Schmezer and W.J. Zeller, Institute for Toxicology and Chemotherapy, German Cancer Research Center, and *Thorax Clinic Rohrbach, Heidelberg, FRG

15.00 **Cytotoxic, Mutagenic and Carcinogenic Effects of Airborne Particulates on Human and Rodent Tissue Culture Cells: A Comparative Study from a Highly Industrialized Area over a Period of 11 Years (1975 – 1986)**
N.H. Seemayer, W. Hadnagy, R. Tomingas and N. Manojlovic, Medizinisches Institut für Umwelthygiene an der Universität Düsseldorf, FRG,

15.15 **Biochemical and Flow Cytometric Analyses for the Evaluation of Inhalative Hazards: Long-term Exposure to Cadmium Aerosols**
F. Otto, D. Hochrainer and U. Glaser,
Fraunhofer-Institut für Umweltchemie und Ökotoxikologie, Schmallenberg-Grafschaft, FRG

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Paper Session C (Lecture Hall M)
Session Chairman: Richard D. Cuddihy, Ph.D.
Co-chairman: Wolfgang Koch, Dr. rer. nat.

14.00 **Toxicokinetics of the Ethyl Ethers of Ethylene Glycol and Ethylene Glycol Acetate in Man**
D. Groeseneken, H. Veulemans and R. Masschelein, Department of Occupational Medicine, Catholic University of Louvain, Louvain, Belgium

14.15 **Interpretation of Regional Deposition Data Based on Human Lung Clearance Studies with Radio-Aerosol Pulses**
W. Stahlhofen, J. Gebhart, G. Rudolf and G. Scheuch, Gesellschaft für Strahlen- und Umweltforschung mbH, Neuherberg, Institut für Biophysikalische Strahlenforschung, Frankfurt am Main, FRG

14.30 **The Effects of Exposure Mode on Dust Retention and Elimination**
J. Bruch, E. Gono, Ch. Li and M. Joos, Institut für Hygiene und Arbeitsmedizin, Universitätsklinikum der Gesamthochschule Essen, Essen, FRG

14.45 **A Macrophage Assay for Intracellular Dissolution of Uniform Aerosol Particles**
W.G. Kreyling, Gesellschaft für Strahlen- und Umweltforschung mbH, München, Institut für Strahlenschutz, Neuherberg, FRG; J.J. Godleski, S.T. Kariya, J.D. Brain, Harvard School of Public Health, Respiratory Biology Program, Boston, MA, USA; R.M. Rose, New England Deaconess Hospital, Division of Pulmonary and Critical Care Medicine, Boston, MA, USA

15.00 **In Vitro Solubility of Particles Using Cultured Alveolar Macrophages. Comparison with In Vitro a Cellular Model and Data of In Vivo Solubility**
S. André, H. Métivier, G. Lantenois and R. Masse, CEA/IPSN/DPS/SPE/ Section de Toxicologie et Cancérologie Expérimentale, Bruyères le Châtel, France

15.15 **A New Monte Carlo Deposition Model for Extrapolation of Animal Exposure Data to Man**
W. Hofmann and L. Koblinger, University of Salzburg, Austria and Central Research Institute for Physics, Budapest, Hungary

15.30 ●●● **Break** ●●●

15.30 – 17.00 **Poster Sessions A and C**

17.00 – 18.30 **Reception for speakers and participants** Hannover Medical School

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Tuesday, March 24

Plenary Session B (Lecture Hall F)

Methodological Issues in Designing and Conducting Studies with Laboratory Animals
Georg Kimmerle, Dr. med., Session Chairman

08.30 **Exposure Facilities and Aerosol Generation and Characterization for Inhalation Experiments**
Werner Holländer, Dr. rer. nat.
Fraunhofer Institute of Toxicology and Aerosol Research

09.10 **Comparison and Interpretations of Different Methods Used in Acute and Subchronic Inhalation Studies with Potential Lung Irritants with Particular Attention to Pulmonary Function Measurements**
Jürgen Pauluhn, Dr. rer. nat.
Bayer AG

09.50 **Chronic Toxicity Inhalation Studies: Protocols and Pitfalls**
Paul E. Morrow, Ph.D.
University of Rochester Medical Center

10.30 ●●● **Break** ●●●

11.00 **Carcinogenicity Protocols**
Richard A. Griesemer D.V.M., Ph.D.
Oak Ridge National Laboratory

11.40 **Panel Discussion**

12.30 ●●● **Lunch** ●●●

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Paper Session B (Lecture Hall F)
Session Chairman: Paul E. Morrow, Ph.D.
Co-chairman: Werner Hollander, Dr. rer. nat.

14.00 **The Interaction between Airborne Pollution and Respiratory Infection: Survival of an Airborne Pathogen, Escherichia coli**
C.M. Wathes and K. Howard, Department of Animal Husbandry, University of Bristol, Langford, Bristol, UK

14.15 **An Investigation of Limitations of a Controlled Vapour Generation System**
R.B. Douglas, London School of Hygiene and Tropical Medicine, London, UK

14.30 **Design and Experience with Head/Nose-exposure Techniques in a 2-year Inhalation Study with Rats**
H.-J. Klimisch, K. Hasenöhrl, B. Hildebrand, BASF Aktiengesellschaft, Department of Toxicology, Ludwigshafen, FRG

15.00 **Increased Efficiency of Animal Use in Acute Inhalation Toxicity Experiments to Determine the LC50 Rat at Different Exposure Periods**
W.F. ten Berge, DSM, Geleen, The Netherlands and A. Zwart, CIVO-TNO, Zeist, The Netherlands

15.15 **Acute Inhalation Toxicity of a Pressurized Aerosol Household Ipsecticide Formulation**
M.V. Moorthy and A. Seshaiah, Department of Toxicology, Fredrick Institute of Plant Protection and Toxicology (FIPPAT), Padappal, India

15.30 ●●● **Break** ●●●

15.30 – 17.00 **Poster Session B**

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Wednesday, March 25

Plenary Session C (Lecture Hall F)

Interpretation of Toxicokinetic Studies with Airborne Toxicants
Werner Stober, Dr. rer. nat., Session Chairman

08.30 **Interspecies Dosimetry of Reactive Gases**
Frederick J. Miller, Ph.D.
U.S. Environmental Protection Agency

09.10 **Deposition of Inhaled Particles in Man**
Joachim Heyder, Dr. phil. nat.
Society for Radiation and Environmental Research

09.50 **Toxicokinetics of Non-reactive Gases**
Melvin E. Andersen, Ph.D.
Armstrong Aerospace Medical Research Laboratory

10.30 ●●● **Break** ●●●

11.00 **Respiratory Tract Clearance of Particles and Substances Dissociated from Particles**
Richard G. Cuddihy, Ph.D.
Lovelace Inhalation Toxicology Research Institute

11.40 **Panel Discussion**

12.30 ●●● **Lunch** ●●●

14.30 – **Workshop (Lecture Hall F)**
17.30 **Inhalation Toxicology of Diesel Exhaust: A Summary of 10 Years of Experimental Research**
Uwe Heinrich, Dr. rer. nat., Fraunhofer-Institut für Toxikologie und Aerosolforschung

Chairman: Roger O. McClellan, D.V.M.
Lovelace Inhalation Toxicology Research Institute

Discussion Panel: D.L. Dungworth, A. Haße, A.G. Hildebrandt, H. Klingenberg, J.L. Mauderly, F. Roe, W. Stöber and J.J. Vostal

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- Thursday, March 26

- Plenary Session D (Lecture Hall F)

Interpretation of Results Using Laboratory Animals
Donald L. Dungworth, Ph.D., Session Chairman

08.30 **Interpretation of Early Lesions in the Mouse Lung: Fibrogenesis and Tumorigenesis**
Hanspeter R. Witschi, M.D.
Oak Ridge National Laboratory

09.10 **Relevance to Man of Experimentally Induced Pulmonary Tumours in Rats and Hamsters**
Ulrich Mohr, Dr. med.
Hannover Medical School
and
Donald L. Dungworth, Ph.D.
University of California, Davis

09.50 **Pathogenesis of NO_2-induced Emphysema: Toxicologic Implications**
Jerome Kleinerman, M.D.
Mount Sinai School of Medicine

10.30 ●●● **Break** ●●●

11.00 **Comparisons of Respiratory Function Responses of Laboratory Animals and Man**
Joe L. Mauderly, D.V.M.
Lovelace Inhalation Toxicology Research Institute

11.40 **Panel Discussion**

12.30 ●●● **Lunch** ●●●

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14.00 **Presentation of the Kenneth Morgareidge Award (Lecture Hall F)**
Dr. Alex Malaspina, President of the International Life Sciences Institute, will be announcing this year's winner of the Kenneth Morgareidge Award and presenting the prize. The recipient will give a 30-minute talk on his work.

Thursday Afternoon Paper Sessions D and E Will Be Presented Concurrently.

Paper Session E (Lecture Hall F)
Session Chairman: Donald L. Dungworth, Ph.D.
Co-chairman: Michaela Aufderheide, Dr. rer. nat.

14.45 **Ozone Removal in the Nasopharynx and Lungs of Normal Man during Tidal Breathing**
J.J. O'Neil, T.A. Gerrity, R.A. Weaver, J.H. Berntsen, J.H. Overton and F.J. Miller, Inhalation Toxicology Division, U.S.E.P.A., Research Triangle Park, NC, USA; School of Public Health, University of North Carolina, Chapel Hill, NC, USA; and Environmental Monitoring Services, Inc., Chapel Hill, NC, USA

15.00 **Ozone Concentration - Response Relationship: Implications for Standard Setting and Risk Assessment**
M.J. Hazucha, University of North Carolina at Chapel Hill, Center for Environmental Medicine, Chapel Hill, NC, USA

15.15 **Short-term Exposure Effect Relationships for Ozone: Influence of Concentration, Exposure Time per Day and Duration of Exposure**
P.J.A. Rombout, L. van Bree, J.A.M.A. Dormans, M. Marra and S.J. Heisterkamp, National Institute of Public Health and Environmental Hygiene, Department of Inhalation Toxicology, Bilthoven, The Netherlands

15.30 **Pulmonary Function Tests in the Risk Assessment of the Effects of Ambient Ozone: An Adverse Health Effect or a Neuromediated Reflectoric Response?**
J.J. Vostal, General Motors Research Laboratories, Warren, MI, USA

15.45 **Panel Discussion**
16.30

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Paper Session D (Lecture Hall M)
Session Chairman: Hanspeter R. Witschi, M.D.
Co-chairman: Uwe Heinrich, Dr. rer nat.

14.45 **Nasal Tumours in Rats after Short-term Exposure to Cytotoxic Concentrations of Formaldehyde Vapour**
V.J. Feron, L.M. Appelman, R.A. Woutersen and J.P. Bruyntjes, TNO-CIVO Toxicology and Nutrition Institute, Zeist, The Netherlands

15.00 **A Rat Model of Physiologic Adaptation to Ozone (O_3)**
D.L. Costa, * J.S. Tepper, * M.J. Wiester, * J.R. Lehmann, M.E. Weber, S. Fitzgerald, M. Stevens and M.E. King,
* Health Effects Research Laboratory, U.S.E.P.A., Research Triangle Park, NC, USA; Northrop Services Inc., Research Triangle Park, NC, USA

15.15 **Centriacinar Airway Remodeling in Rats Chronically Exposed to Ozone**
D.M. Hyde, B.C. Barr, C.G. Plopper and D.L. Dungworth, California Primate Research Center, University of California, Davis, CA, USA

15.30 **Role of Vitamin E in the Differing Response to NO_2 Injury in the Rat and the Hamster**
K. Miller, D. Bayley and D.G. Walters, British Industrial Biological Research Association, Carshalton, Surrey, UK

Session D paper presentations will continue in Lecture Hall F.

16.30 **Dosimetric Considerations for Extrapolating Results of Rat Inhalation Studies to Humans: Cadmium Carcinogenicity Studies as an Example**
G. Oberdörster, University of Rochester, Dept. of Biophysics, Rochester, NY, USA

16.45 **Can Animal Data Relate to Human Bronchogenic Effects?**
J.N. Pritchard and A. Black, Environmental & Medical Sciences Division, A.E.R.E. Harwell, Oxon, UK

17.00 **••• Break •••**

17.00 – 18.30 **Poster Sessions D and E**

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Friday, March 27

Plenary Session E (Lecture Hall F)

Risk Assessments for Airborne Toxicants
Alfred G. Hildebrandt, Dr. med., Session Chairman

08.30 **Population Studies in Risk Assessment: Strengths and Weaknesses**
Margaret R. Becklake, M.D.
McGill University

09.10 **Human Clinical Exposure Studies: Body Box or Pandora's Box**
Mark J. Utell, M.D.
University of Rochester Medical Center

09.50 **Occupational Exposure Standards in Europe: History, Present Status and Future Trends**
Dietrich Henschler, Dr. med.
University of Würzburg

10.30 ●●● **Break** ●●●

11.00 **Current Approaches for Determining Work Place Exposure Limits in the USA**
Trent R. Lewis, Ph.D.
National Institute of Occupational Safety and Health

11.40 **Correlation of Carcinogenic Potency Estimated from Animal and Human Data**
Kenny S. Crump, Ph.D.
K.S. Crump & Co., Inc.

12.20 **Closing Remarks**
Ulrich Mohr, Dr. med.

●●● **End of Symposium** ●●●

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Appendix

Posters

The poster presentations will be arranged in the vestibule. Each poster will display a letter corresponding to one of the topic categories of the Symposium (A, B, C, D or E) and a number. The posters will be arranged in numerical order, irrespective of the topic categories to which they belong.

Poster Session A

1 A **Benzo(a)pyrene-7,8-diol-9,10-epoxide(BPDE)DNA-Adducts and Monooxygenase Activities in Mice Treated with Cigarette Smoke (CS) or Benzo(a)pyrene (BP) in Vivo**
N.M. Bjelogrlic, M. Iscan, O. Pelkonen and K. Vahakangas, Department of Pharmacology, University of Oulu, Oulu, Finland.

7 A **Acute Bronciolar Damage of Bromobenzene Inhalation in Mice and Rats**
J.E. Dahl, K. Aarstad, O. Nilsen and E. Dybing, Department of Toxicology, National Institute of Public Health, Oslo, and Department of Pharmacology and Toxicology, University of Trondheim, Trondheim, Norway.

13 A **Solubility Studies on an Industrial Plutonium Dust**
P.P. Foster, I. Pearman, M.E.D. Bains and D. Ramsden, AEE Winfrith, Dorchester, Dorset, UK.

25 A **Analysis of Phospholipid/Apoprotein Ratio in Extracellular Surfactant after Exposure to Nitrogen Dioxide or a Methyl Furan Derivative**
F. Lawrence and K. Miller, British Industrial Biological Research Association, Carshalton, Surrey, UK.

28 A **Cyto- and Genotoxic Effects of Automobile Exhaust on Mammalian Cells In Vitro**
W. Hadnagy and N.H. Seemeyer, Medical Institute of Environmental Hygiene at the University, Düsseldorf, FRG.

31 A **Urinary Metabolite Profiles and Pharmacokinetics of Antipyrine in Smokers and in Ex-smokers**
R. Schüppel, H. Bassmann, Institut Pharmakologie & Toxikologie, Technische Universität Braunschweig, FRG.

70 A **Factors Controlling Particle Elimination and Penetration in the Lung: Effects of Dust Properties**
Ch. Y. Li, J. Bruch, F. Gono, B. Rehn, Institut für Hygiene und Arbeitsmedizin, Universitätsklinikum der Gesamthochschule Essen, Essen, FRG.

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Poster Session B

2 B **Dual Way Characterization of Aerosols by the Galaicis-1 — A Powerful Tool for Inhalation Exposures**
E.F. Aharonson, Q. Bernstein and N. Karasikov, Israel Institute for Biological Research, P.O. Box 19, Ness-Ziona, 70450 and Gadar Labs Inc., Migdal Ha-Emek, Israel

8 B **A System for the Exposure of Mice to Toxic Aerosols**
A. Black, J.N. Pritchard and M. Walsh, Environmental & Medical Sciences Division, A.E.R.E. Harwell, Oxon, UK.

14 B **Effect of Diurnal or Nocturnal Ozone Exposure on the Pulmonary Response of Rats**
L. van Bree, P.J.A. Rombout, M. Marra, P.H.B. Fokkens, A.J.F. Boere and J. Bos, National Institute of Public Health and Environmental Hygiene, Department of Inhalation Toxicology, Bilthoven, The Netherlands

20 B **Factors Affecting Particle Clearance from the Rat Lung**
C.G. Collier, A. Hodgson, M.R. Bailey and S.E. Barry, National Radiological Protection Board, Chilton, Didcot, Oxon, UK.

26 B **Outline of Facilities and Activity of Japan Bioassay Laboratory**
K. Nozaki, E. Nakayama and M. Enomoto
Japan Bioassay Laboratory, Kanagawa, Japan.

32 B **An Experimental Rabbit Model for Studying Acute Effect of Environmental Irritant Aerosols and Gases on Respiration, Heart and Circulation**
M.S. Islam, D. Haake, E.J. Reuter, Medizinisches Institut für Umwelthygiene, Düsseldorf, FRG.

36 B **Inhalation Toxicity Studies of Formaldehyde in Rats: 8-hour Continuous Versus 8-hour Intermittent Exposures**
J.W.G.M. Wilmer, R.A. Woutersen and V.J. Feron, TNO-CIVO Toxicology and Nutrition Institute, Department of Biological Toxicology, Zeist, The Netherlands.

37 B **Exhalation Rates of Volatile N-Nitrosamines in Comparison with Nitrosamine Blood Levels after Different Modes of Application in Rats**
R.G. Klein, B. Schmezer, P. Schmezer, B. Spieglhalder and D. Schmähl, Institute of Toxicology and Chemotherapy, German Cancer Research Center, Heidelberg, FRG.

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42 B **Design and Performance Characteristics of an Inhalation Chamber for the Exposure of Small Laboratory Animals to Low Concentrations of Air Pollutants**
M. Marra, P.J.A. Rombout and H.W. Ballfoort, National Institute of Public Health and Environmental Hygiene, Department of Inhalation Toxicology Bilthoven, The Netherlands

46 B **A New Inhalation Apparatus Designed for Dogs and its Application to Toxicity Study of Volcanic Ash**
R. Nagata and M. Nitzek*, Shin-Nippon Biomedical Laboratories Ltd. Kagoshima and *Shibata Scientific Technology Ltd., Tokyo, Japan.

50 B **The Effect of Restraint in Nose-only Exposure Tubes during Pregnancy on Teratogenic Endpoints in Sprague Dawley Rats**
A.I. Nikiforov and G. Adgower, Battelle, Centre for Toxicology and Biosciences, Geneva, Switzerland.

58 B **Health Effects of Diesel Exhaust: The Influence of Enzootic Infections on the Incidence of Primary Lung Tumors in Diesel Exhaust Exposed Male Rats**
O.R. Moss, B.J. Greenspan, R.H. Busch, R.E. Buschbom, S.E. Rowe, Battelle Pacific Northwest Laboratories, Richland, WA 99352 and R.M. Schreck, Biomedical Science Department, General Motors Research Laboratories, Warren, MI 48090, U.S.A.

59 B **Health Effects of Diesel Exhaust: The Influence of Age during Exposure on the Incidence of Primary Lung Tumors in Diesel Exhaust Exposed Male Rats**
O.R. Moss, B.J. Greenspan, R.H. Busch, R.E. Buschbom, S.E. Rowe, Battelle Pacific Northwest Laboratories, Richland, WA 99352 and R.M. Schreck, Biomedical Science Department, General Motors Research Laboratories, Warren, MI 48090, USA

63 B **Animal Inhalation Facilities and Experimental Design for Diesel Engine Emissions**
T. Suzuki, T. Nakajima, J. Sueyoshi and S. Ishiwata, (JHERP), Japan Automobile Research Institute, Ibaraki, Japan.

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Poster Session C

3 C **The Effect of a "Nuisance" Dust Inhalation on Lung Clearance**
B. Bellmann, H. Muhle and O. Creutzenberg, Fraunhofer-Institut für Toxikologie und Aerosolforschung, Hannover, FRG.

9 C **Pulmonary Distribution of Different Aerosol Particles as a Function of Time after Inhalation by Rats**
E. Drosselmeyer*, H.L. Muhle*, S. Pickering**, A. Seidel*.
*Kernforschungszentrum Karlsruhe, Institut für Genetik und Toxikologie, Karlsruhe,
*Commission of the European Communities, Joint Research Center, European Institute for Transuranium Elements, Karlsruhe, FRG.

15 C **Pharmacokinetics of Inhaled 2-Nitropropane in the Rat**
B. Denk, E. Deml, D. Oesterle, K.H. Summer and J.G. Filser, Institut für Toxikologie, GSF, Neuherberg, FRG.

21 C **Physiologically Based Modeling of Organic Solvent Toxicokinetics by Spreadsheet Programming on a PC**
G. Johanson and P.H. Naslund, National Board of Occupational Safety and Health, Solna, Sweden.

22 C **Pulmonary Deposition, Retention, and Clearance of a Pigmented Polymer in Rats**
H. Muhle*, B. Bellmann*, O. Creutzenberg*, R. Kilpper** and R. Mermelstein**
* Fraunhofer-Institut für Toxikologie und Aerosolforschung, Hannover, FRG.
** Joseph C. Wilson Center for Technology, Xerox Corporation, Rochester, NY, USA.

27 C **Kinetics of the Accumulation in the Lung and Associated Lymph Nodes of Inhaled Mineral Dusts during Prolonged Chronic Exposure**
J.H. Vincent, A.D. Jones, A.M. Johnston and C. McMillan, Institute of Occupational Medicine, Edinburgh, Scotland, UK.

33 C **Carbon Fibres: Results of a Further Survey of Process Workers and their Environment in a Factory Producing Continuous Filament**
H.D. Jones, Courtaulds plc, Coventry, W. Midlands, UK.

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38 C **Non-linear Relationship between the Dose Deposited in the Respiratory Tract and the Dose to Target Tissues**
M.A. Medinsky and R.O. McClellan, Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM 87185, USA.

39 C **Toxicokinetics of Inhaled Pure and Particle-associated Organic Chemicals**
J.A. Bond, J.D. Sun, M.A. Medinsky, C.E. Mitchell, R.K. Wolff and R.O. McClellan, Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM 87185, USA.

47 C **Significance of the Extraalveolar Perivascular Sheath in the Alveolar Clearance of Insoluble Particles**
S. Takenaka, H. Muhle, B. Bellmann and U. Mohr, Fraunhofer-Institut für Toxikologie und Aerosolforschung, Hannover, FRG.

55 C **Accumulation of Ethoxyacetic Acid During Repeated Exposures to the Ethyl Ethers of Ethylene Glycol and Ethylene Glycol Acetate**
H. Veulemans, D. Groeseneken, R. Masschelein, E. van Vlem, Department of Occupational Medicine, Catholic University of Louvain, Louvain, Belgium.

60 C **Interspecies Comparisons of Pulmonary Responses to Inhaled Particles and Fibers: Implications for Toxicologic Evaluations**
D.B. Warheit, M.S. Stefaniak and M.A. Hartsky, Du Pont-Haskell Laboratory, Newark, DE, USA.

64 C **Fate of Inhaled Particles, Determined by Neutron Activation**
A.P. Wehner, Battelle, Pacific Northwest Laboratories, Richland, WA, USA.

68 C **Concentration-time Relations in Acute Inhalation Toxicity. A Theoretical Study**
A.L.M. Rutten, A. Zwart, P.G.J. Reuzel, TNO-CIVO Toxicology and Nutrition Institute, AJ Zeist, The Netherlands.

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Poster Session D

4 D **The NTP/NIEHS Studies on Methyl Isocyanate**
J.R. Bucher, E.E. McConnell, B.A. Schwetz and M.D. Shelby, National Toxicology Program, National Institute of Environmental Health Sciences, Research Triangle Park, NC 27709, USA.

5 D **Early Response of the Surfactant and Antioxidant Systems in Rat Lungs after Cadmium Chloride Inhalation**
J. Boudreau, R. Vincent, D. Nadeau*, B. Trottier, M. Fournier, K. Krzstyniak and G. Chevalier, Université du Québec à Montréal, Québec, Canada, and *Université de Sherbrooke, QC, Canada.

10 D **Effects of a "Nuisance" Dust Inhalation on Lavagable Lung Cells**
O. Creutzenberg, B. Bellmann, M. Ocak and H. Mu[illegible] Fraunhofer-Institut für Toxikologie und Aerosolforschung, Hannover.

11 D **Methyl Isocyanate (MIC) Toxicity in Rats and Guinea Pigs Following Acute, High Concentration Exposure**
D.E. Dodd, M.R. Fedde, E.H. Fowler, C.M. Troup, L.A. Magnuiss and F.R. Frank, Bushy Run Research Center, Union Carbide Corporation, Export, PA, USA.

16 D **Eicosanoid Production by Rabbit Alveolar Macrophages after In Vitro and In Vivo Ozone Exposure**
K.E. Driscoll and R.B. Schlesinger, Institute of Environmental Medicine, New York University Medical Center, NY, USA.

17 D **Morphogenesis of the Lung Cancer Induced by Diesel Emission**
S. Kitamura, Y. Takaki, N. Kuwabara and Y. Fukuda, Juntendo University School of Medicine, Tokyo, Japan.

23 D **The Effect of Duse Inhalation on Bacterial Clearance from the Lung**
M.I. Gilmour, F.G.R. Taylor and C.M. Wathes, School of Veterinary Science, University of Bristol, Langford House, Langford, Bristol, UK.

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29 D **Comparison of Respiratory Functions in Fischer 344 and Wistar Rats**
U. Heinrich and A. Wilhelm, Fraunhofer-Institut für Toxikologie und Aerosolforschung, Hannover, FRG.

34 D **Electron Microscopic Studies on Rat Lungs after Prolonged Exposure to Diesel Engine Exhaust**
A. Kato, S. Ishiwata (HERP), Japan Automobile Research Institute, Inc., Ibaraki, Japan.

35 D **Nasal Tumours in Rats after Severe Injury to the Nasal Mucosa and Exposure to Formaldehyde Vapour**
V.J. Feron, H.R. Immel, L.M. Appelman, R.A. Woutersen and A. Zwart, TNO-CIVO Toxicology and Nutrition Institute, Zeist, The Netherlands.

40 D **Use of Bronchoalveolar Lavage to Assess the Toxicity of Airborne Materials**
R.F. Henderson and R.O. McClellan, Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM 87185, USA.

41 D **The Larynx as a Potential Target Organ in Aerosol Inhalation Studies on Rats**
D.R. Klonne, R.H. Garman, W.M. Snellings, D.E. Dodd and B. Ballantyne, Bushy Run Research Center, Export, PA, USA.

43 D **Subchronic Inhalation Study of Pigmented Polymer in Rats**
H. Muhle*, U. Mohr*, S. Takenaka*, W. Koch*, R. Fuhst*, R. Kilpper** and R. Mermelstein**
* Fraunhofer-Institut für Toxikologie und Aerosolforschung, Hannover, FRG
** Joseph C. Wilson Center for Technology, Xerox Corporation, Rochester, NY, USA.

44 D **Long-term Inhalation Study with Hamsters and Mice Using Various Cadmium Compounds**
U. Heinrich, R. Fuhst, H. König, L. Peters and S. Takenaka, Fraunhofer-Institut für Toxikologie und Aerosolforschung, Hannover, FRG.

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45 D **Endogenous Lipid Pneumonia Induced by Methylnaphthalene, a Combustion Gas of Kerosine, in $C_6B_3F_1$ Mice**
Y. Konishi*, Y. Emi*, T. Taki**, Y. Murata* and Y. Yokose*,
* Department of Oncological Pathology, Cancer Center, Nara Medical College and ** Department of Biochemistry, Shizuoka College of Pharmacy, Japan.

48 D **Modification of Lung Tumor Growth by Hyperoxia**
R.C. Lindenschmidt* and H.P. Witschi, Biology Division, Oak Ridge National Laboratory, Oak Ridge, TN, USA.
* Present address: The Procter & Gamble Company, Miami Valley Laboratories, Cincinnati, OH, USA.

49 D **Effect of a "Nuisance" Dust Inhalation on Immunologic Functions of Rat Alveolar Macrophages**
M.-L. Lohmann-Matthes and H. Muhle, Fraunhofer-Institut für Toxikologie und Aerosolforschung, Hannover, FRG.

52 D **Carcinogenicity of Diesel Exhaust Inhaled Chronically by Rats**
J.L. Mauderly, R.K. Jones, W.C. Griffith, R.F. Henderson and R.O. McClellan, Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM 87185, USA.

53 D **Relative Effects of Inhaled Nitrogen Dioxide and Diesel Exhaust in Adult Rats with Developing Lungs**
J.L. Mauderly, D.E. Bice, N.A. Gillett, R.F. Henderson, J.A. Pickrell and R.K. Wolff, Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM 87185, USA.

56 D **Early Distribution of an Inhaled Radioaerosol in Rats**
A.N. Payne, R.W. Lees, M.J.S. Gazeley, P.M. Webbon and G.E. Woolley, Department of Mediator Pharmacology, Wellcome Research Laboratories, Beckenham, Kent, UK, Central Analytical Laboratories (Biological), The Wellcome Foundation Limited, Dartford, Kent, UK, and Departments of Medicine and Surgery, The Royal Veterinary College Field Site, Hatfield, Hertfordshire, UK.

57 D **Chronic Effects Following Long-term Exposure to Gasoline Engine Exhaust in Rodents**
U. Heinrich, L. Peters and B. Bellmann, Fraunhofer-Institut für Toxikologie und Aerosolforschung, Hannover, FRG.

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61 D **The Role of Complement in the Early Pathogenesis of Asbestosis**
D.B. Warheit, L.H. Overby and A.R. Brody, Du Pont-Haskell Laboratory, Newark, DE, USA, and NIEHS, NC, USA.

62 D **Cell-to-cell and Cell-to-fiber Interactions in Asbestos-induced Lung Disease**
K.E. Pinkerton and R.R. Mercer, University of California, Davis, CA, USA, and Duke University, Durham, NC, USA.

65 D **Degenerative, Inflammatory, and Proliferative Lesions of the Nasal Mucosa of Rats and Mice Exposed by Chronic Inhalation to Selected Organic Chemicals with Potential for Human Occupational Exposure**
R.A. Renne, R.A. Miller, W.E. Giddens, Battelle Northwest Laboratories, Richland, WA, USA and G.A. Boorman and R.R. Maronpot, National Institute of Environmental Health Sciences, Research Triangle Park, NC, USA.

66 D **Long-term Inhalation Studies on Effect of Exhaust from Heavy and Light Duty Diesel Engines on F-344 Rats**
Y. Takaki, S. Kitamura, N. Kuwabara and Y. Fukuda, Juntendo University School of Medicine, Tokyo, Japan.

69 D **Hyaluronic Acid in Bronchoalveolar Lavage; a Marker of Fibrotic Development in Quartz-exposed Rats?**
G. Tornling, A. Eklund, G. Unge and R. Hernbrand, Department of Thoracic Medicine and Department of Clinical Chemistry, Karolinska Hospital, Stockholm, Sweden.

71 D **Age-dependent Changes and Non-neoplastic Surface Protrusions in the Laryngeal and Tracheal Epithelium of the Syrian Golden Hamster (Mesocricetus auratus)**
C. Brockmeyer and U. Heinrich, Fraunhofer-Institut für Toxikologie und Aerosolforschung, Hannover, FRG.

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Poster Session E

6 E **Exposure to MMMF in the Indoor Non-occupational Environment**
G.R. Lundqvist, Institute of Hygiene, Aarhus, Denmark.

24 E **Theoretical Development of Mechanism of Chemical Carcinogenesis — Di-Region Theory**
Q. Dai, Center for Chemistry and Bioengineering of Cancer, Beijing Polytechnic University, Beijing, People's Republic of China.

30 E **Influence of Xenobiotics on the Toxicokinetics of Toluene in Man**
M. Wallén, National Board of Occupational Safety and Health, Solna, Sweden.

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